Monitoring and Modelling of Soil Moisture in Lower Franconia (Germany)

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This research is part of the integrated project “BigData@Geo - Advanced Environmental Technology Using AI In The Web” funded by the European Regional Development Fund (ERDF). The aim of this ERDF-project is to develop a high-resolution regional earth system model for the region of Lower Franconia. One sub-project is dedicated to regional soil moisture modelling created with WaSiM-ETH based on soil moisture monitoring data. The second sub-project aims to improve the resolution of the regional climate model REMO. Both models will be combined to form the earth system model.

Lower Franconia is amongst the regions in Germany, which will be strongly affected by climate change. Regional climate models show that average temperatures will rise and dry periods as well as extreme precipitation events occur more often. However, it is still not known, what effect the changing climate conditions – especially dry periods and extreme precipitation events – will have on the soils in Lower Franconia.

Yields of forestry and agriculture (including viticulture and pomiculture) depend very much on the availability of soil water. During the growing season the water retention capacity of soils is therefore highly relevant. Up to present, datasets as well as modelling results of future scenarios on soil moisture are only scarcely available on local as well as on regional scale. In order to generate future scenarios, calculation of the soil moisture regime forms the base in order to evaluate present day conditions as well as to develop prognostic studies. As we intend to obtain most realistic parameters, generation of real-time data with high temporal resolution at selected sites is crucial. They are characteristic for Lower Franconia serving as calibration regions for modelling approaches. The operating monitoring stations record soil moisture and - temperature as well as meteorological parameters.

In order to obtain data on dynamics and causes of soil moisture fluctuation as well as to understand process flows, soil geographical surveys form an essential component of our research design for selected sites related to the monitoring stations. Furthermore, relevant sedimentological and pedological parameters such as grain size distribution, permeability, and bulk density are analyzed in the laboratory. Thus, our representative test sites combine detailed ground-truth data combining soil moisture and soil quality and thus, form consecutive modules as parts of soil moisture models. These modules drive and control the modelling procedures of the sub-project and they further serve for assessment and calibration of the area-wide hydrological and climate modelling in the “BigData@Geo” ERDF-project.